Mechanical Injuries

1. Define Injury
Types of Mechanical Injuries
Write in detail about bruises and its medicolegal aspects-

- Injury → Any harm, whatever illegally, caused to any person in body, mind, reputation or property.

BNS section – 2 (14)

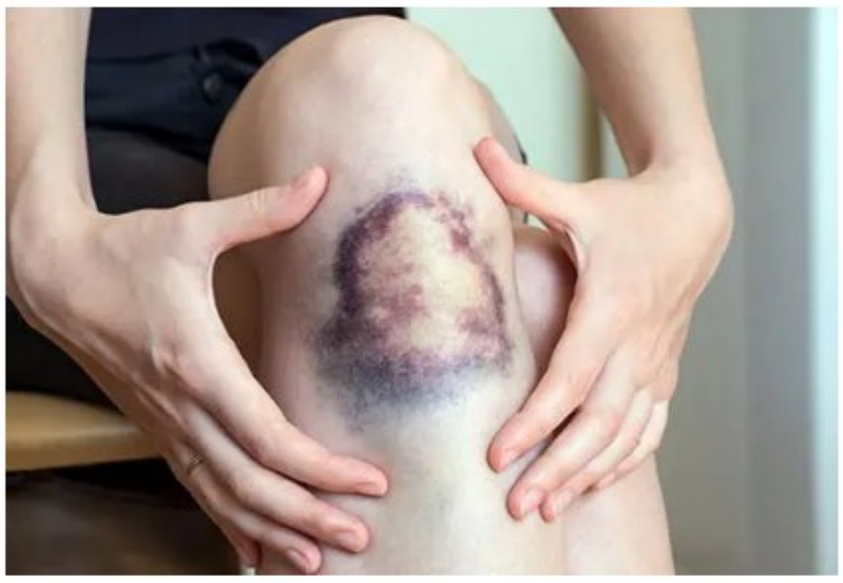
IPC section – 44

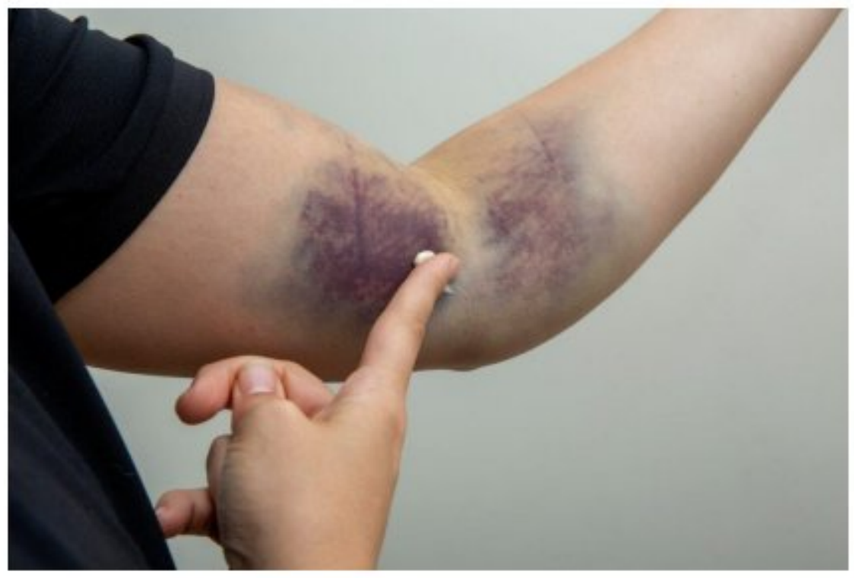
Mechanical Injuries →

- Injuries which produced physical voilence are called Mechanical injuries.
- Also called Physical injuries.
- Types :-
  - i) Abrasion
  - ii) Bruise or Contusion
  - iii) Laceration
  - iv) Incised wound
  - v) Stab wound or Puncture wound.
  - vi) Firearm wound
  - vii) Fracture/ dislocation of bone / tooth / joint.

Bruise or Contusion →

- Bruise is an extravasation or collection of blood due to rupture of blood vessels caused by application of mechanical force of blunt nature without loss of continuity of tissue.
- Skin is intact and margins are blurred.





Mechanism →

- Produced by blunt force trauma (blow, fall, impact with blunt object)
- Impact compresses & crushes the soft tissues
↓
Ruptures small blood vessels (capillaries, venules)
↓
Blood escapes into surrounding tissues
↓
Discoloration appears on the surface.

Causes →

i) By application of blunt force viz. blow with fists, sticks, iron-bar, cane, whip or chain.

ii) From compression, like pressing fingers.

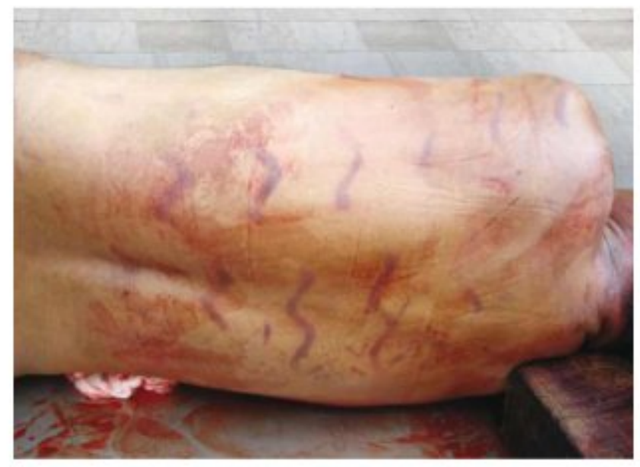
iii) Medical intervention sometimes produces bruise – sternal and cardiac bruising, bruising around needle puncture marks and pinching skin to test conscious level (butterfly bruise).

Types →

1) **Intradermal Bruise** →

- Bruise situated in sub-epidermal layer of skin.

- Patterned bruises often associated; more prominent due to translucency of skin.
- Occur at point of application of force.
- Margins quite distinct.
- Ext motor tyre marks, whip impacts, rubber sole marks.



ii) **Subcutaneous bruise** →

- Commonest type, located in subcutaneous tissue (above deep fascia)
  → superficial bruise.
- Below deep fascia → deep contusion (delayed appearance)
- Margins appear blurred at edges.

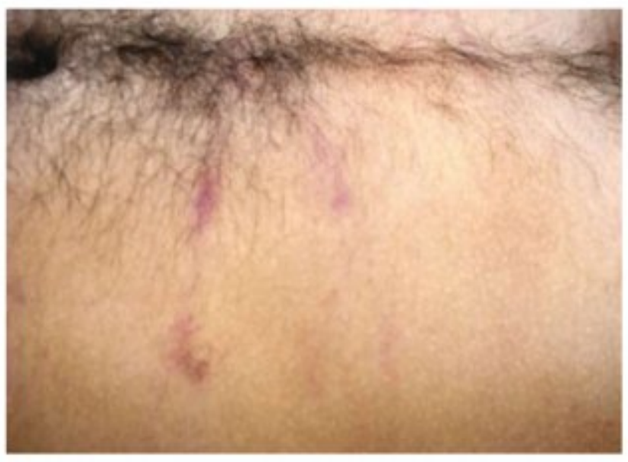


FIG. 9.20: Superficial contusion

iii) **Patterned Contusion** →

- Imprint / design of offending object visible on skin.
- Provides vital information about weapon.
- Ex: Discoid contusions (manual strangulation), tyre mark, shoe sole mark, tram-line contusion.

iv) **Shifting bruise** →

- Bruise appears away from site of force (due to gravity, fascial planes)
- Migratory / Ectopic / Percolated bruise.
- Ex: forehead contusion → black eye, arm → lower elbow.

v) Tram line Contusion →

- Two paralell hemorrhagic lines with intact skin in between.
- Caused by rod, stick, whip, belt.
- Mechanism : blood displaced sideways under compressed skin.

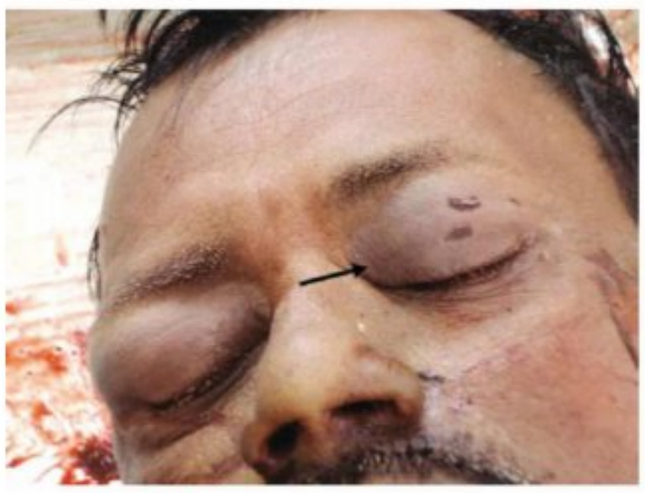


FIG. 9.21: Shifting bruise—black eye

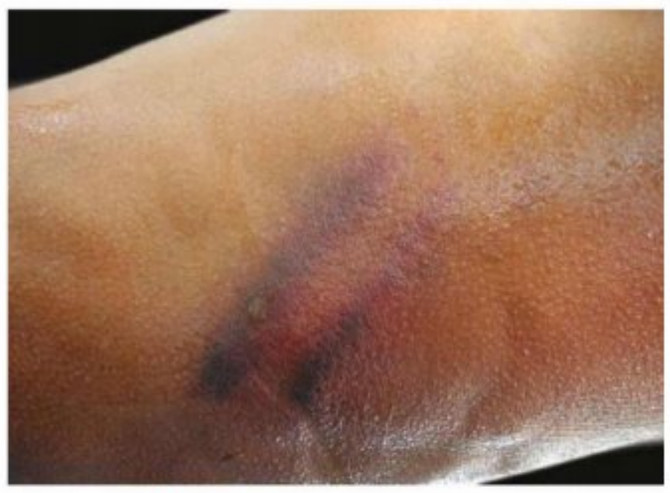


FIG. 9.22: Tram-line contusion

vi) Six-penny bruises →

- Discoid bruised ~1cm, caused by finger tip pressure.
- Seen on neck (manual strangulation) on arms/wrist in child abuse.

vii) Tissue Organ Contusion →

- Brain contusion → swelling, impaired function, brainstem, contusion often fatal.
- Heart contusion → arrhythmia, cardiac failure.
- Other organ contusion → rupture, internal bleeding.

Factors affecting Bruise formation →

i. Condition of tissue → bruises form easily in lax tissue (eyelid, scrotum)
ii. Body part → unyielding areas (head, shin) bruise more.
iii. Situation → superficial = visible, deep = seen on dissection.
iv. Condition of blood vessels → fragile in old age = easy bruising.
v. Presence of disease → Scurvy, hemophilia, aspirin - easy bruising.
vi. Sex → women bruise more (more subcutaneous fat).

vii. Age → children and elderly bruise more.

viii. Skin colour → more visible in fair skin.

ix. Optical character → superficial = red, deep = bluish.

Age of Bruise →

Age	*Changes*	*Caused by*
Fresh	Red	Fresh extravasation of blood
1-3 days	Bluish	Deoxyhemoglobin
4 days	Bluish black to brown	Hemosiderin pigment
5-6 days	Greenish	Hematoidin pigments
7-12 days	Yellow	Bilirubin pigments
2 week	Complete disappearance of contusion	--

Postmortem Vs Antemortem Contusion →

- Antemortem : swelling present, extravasation of blood, inflammation, considerable hemorrhage.
- Postmortem : swelling absent, no extravasation, no inflammation, insignificant hemorrhage.

Complications →

i. Death if inflicted on vital parts (neck, heart)

ii. Shock & hemorrhage in multiple contusions.

iii. Painful lesions, intestinal ischemia / gangrene.

iv. Bacterial proliferation, pulmonary fat embolism.

Differential diagnosis →

- The bruise may confused with postmortem lividity, congestion, purpura, artificial bruises.

Artificial bruises →

- Produced by irritant substances / juices causing vesication.
- Done with malicious intent to make false allegations.

Medicolegal importance →

- Offending weapon can be known.
- The age of injury can be determined.
- Character and manner of injury can be knocon.
- Application of degree of voilence can be estimated.
- A bruise is usually simple injury, but if present on vital poonts or organs may amount to grevious hurt or may cause death.
- Injection of embalming fluid often enhances the appearance of contusion on the body surface.

2. Laceration-

- Laceration wound is a form of mechanical injury caused by hard and blunt force impact characterized by splitting or tearing of tissues.

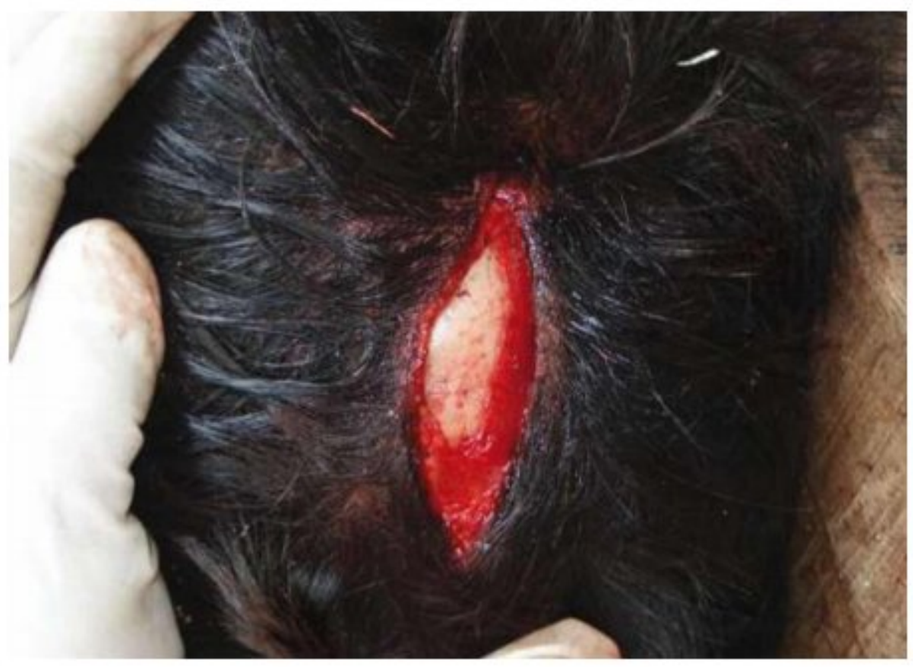
Mechanism →

- When the skin or other structures subjected to blunt forces, the tissue gets crushed or stretched beyond the limits of their elasticity leading to tearing of the skin or other tissue thus producing laceration.
- Laceration differs from incised wounds because in laceration, the continuity of the tissues is disrupted by tearing rather than slicing.

Types of Lacerated wounds →

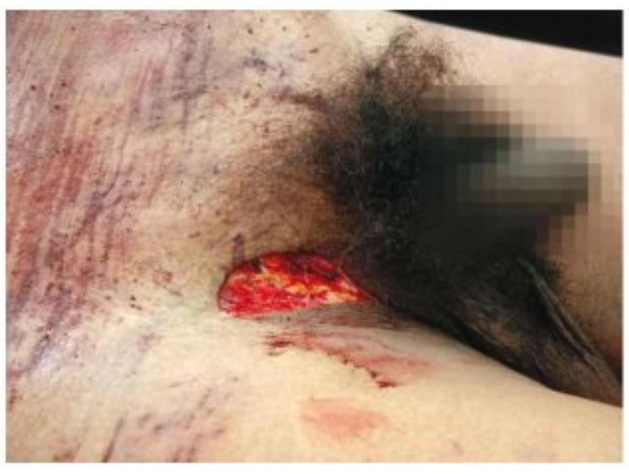
i. Split Laceration →

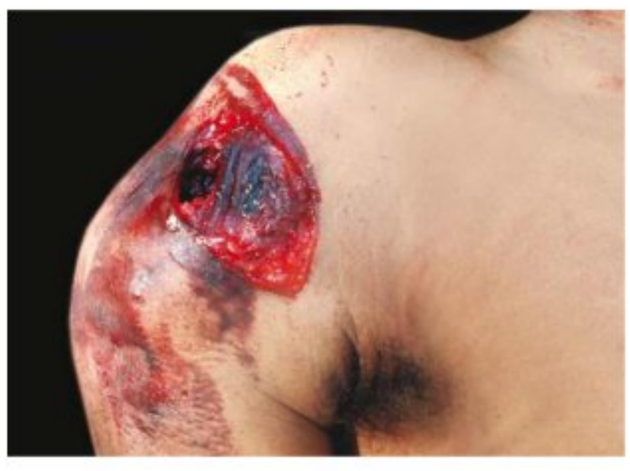
- Also called as incised looking laceration.
- Caused by blunt force splitting the thickness of the skin when soft tissues are crushed b/w impacting force and underlying bone.
- Common sites : scalp, face, shin.



ii) Stretch Laceration →

- Results due to over-stretching of the fixed skin, till it ruptures.
- Pulling forces causes stretch laceration.
- Seen in road traffic accidents - striae like lacerations at groin, thigh, abdomen.

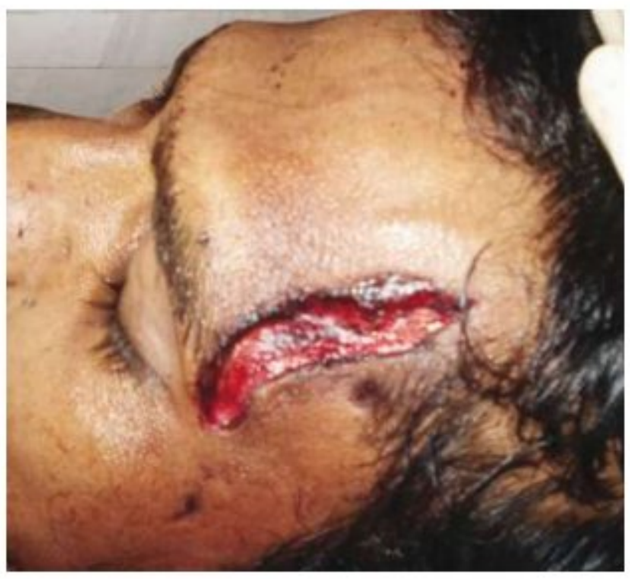




iii) Tear Laceration →

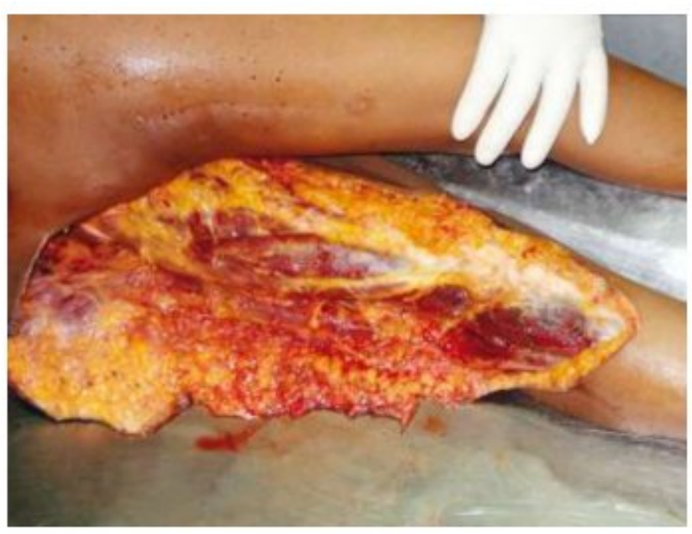
- Common form of laceration.
- Tearing of skin and subcutaneous tissue from localized impact

by hard and blunt force.



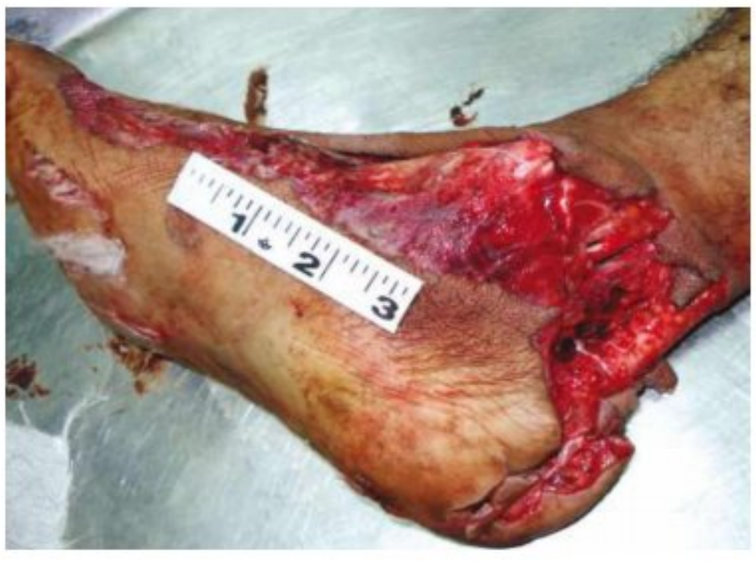
iv) Avulsion Laceration →

- Also called as "Flaying injury or de-gloving injury".
- Skin gets detached from deeper tissues by rotatory action.
  e.g motor wheel.



v) Crush laceration →

- Grinding and compression force causes crushing of tissues, may cause total or partial amputation of limb.



vi) Cut laceration →

- Caused by not-so-sharp edge of weapon, often considered incised wound by many authorities.

Patterned Laceration →

- Weapons may produce patterned laceration but patterns are not as prominent as abrasion or bruise.
- Hammer may produce circular/ crescent laceration :. long thin objects → linear, heavy blow → stellate.

Boxer's Laceration →

- Found in boxer's engaged in active boxing when a boxing glance presses on the orbital margin.

Features of Lacerated wound →

i. Continuity of tissues disrupted by tearing/ splitting, not slicing.
ii. Three dimensional injury - length, breadth, depth.
iii. Margins are irregular, ragged, may be slightly inverted.
iv. Wounds gape open.
v. Bruishing and crushing of edges, requires lens for viewing.
vi. Underlying nerves, tissue bridges visible.
vii. Hair bulbs crushed and ends may show shallow tails.
viii. Bleeding less than incised wound (due to vessel crushing & thrombosis).
ix. Foreign bodies or grit may be embedded.
x. Shape/size may not correspond to weapon.

Laceration of Organs →

- Blunt trauma may cause internal laceration even without external injury (eg. pancreas after abdominal kick).

Complications →

i. Hemorrhage and Shock.

ii. Death

iii. Infection - portal of entry for bacteria.

iv Pain and dysfunction of affected body part.

Mediolegal importance →

i. Cause of injury can be known.

ii. Type of lacerated wound may be known.

iii. Nature of injury - simple or grevious.

iv. Foreign bodies in wound help identify weapon / place.

v. Age of injury can be estimated.

vi. Helps to determine accidental, suicidal or homicidal nature.

vii. Direction of force can be known.

viii. May be confused with incised wound.

Difference b/w lacerated and incised wound (Chop wound) →

Feature	*Lacerated wound*	*Incised wound*
Edges	Lacerated, irregular, ragged	Clean cut
Bruising of margins	Present	No bruising
Injury to blood vessels, nerves	Crushed	Clean cut
Hair bulbs	Crushed	Clean cut
Bleeding	Less	More
Underlying bone	No sharp injury	Sharp linear injury

3. Abrasions-

- An abrasion is a type of mechanical injury characterized by loss of superficial layer of skin (i.e epidermis) or mucous membrane due to application of mechanical force.

Features →

- Pure abrasion involves only epidermis.
- Abrasions do not ordinarily bleed. However, dermis may be involved and thus abrasion exhibits bleeding.
- An abrasion does not leave scar on healing.

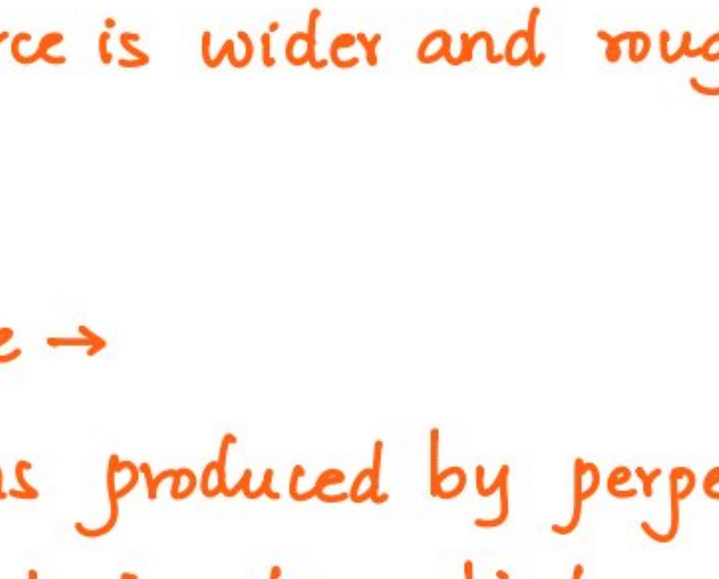
Mechanism of Production →

a) Sliding force (friction) →

- If causative force is narrow and sharp, linear abrasion is produced.
- If causative force is wider and rough, abrasion is wider → graze abrasion.

b) Compression force →

- Imprint abrasions produced by perpendicular force acting on skin with imprint of acting object.
- Pressure abrasions produced by perpendicular force with movement crushing superficial epidermis (e.g: ligature mark).

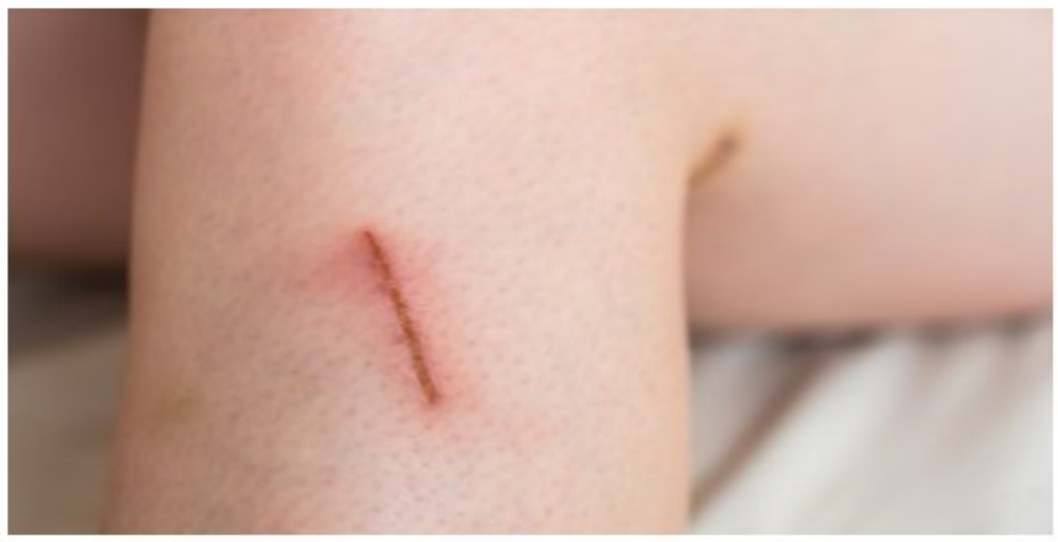


FIGS 9.2A and B: Mechanism of production of abrasion. **A:** Force acting tangentially producing linear or graze abrasion **B:** Force acting perpendicularly causing imprint abrasion

Types of Abrasion →

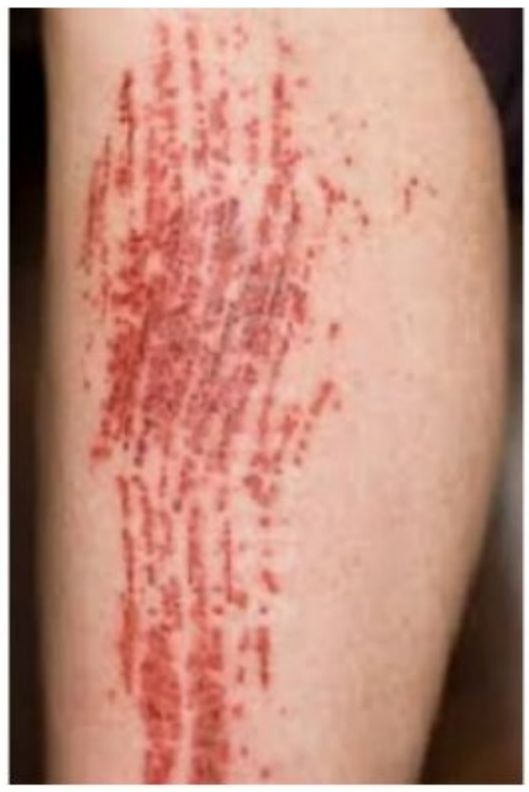
i) Linear abrasion →

- Caused by sliding movement of sharp, narrow objects such as pin, thorn, prickle -etc.
- Wider at starting point with heaping of epithelium at the end indicates direction of movement.
- Also called as Scratch abrasion.



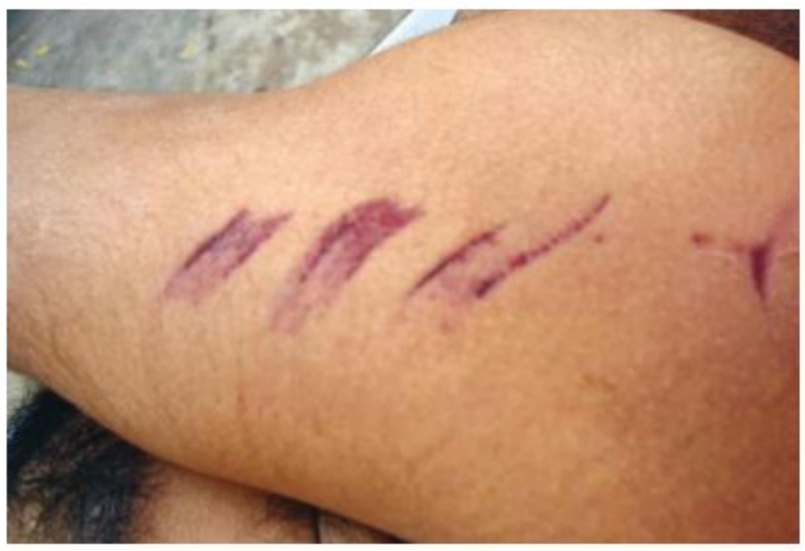
ii) Graze abrasion →

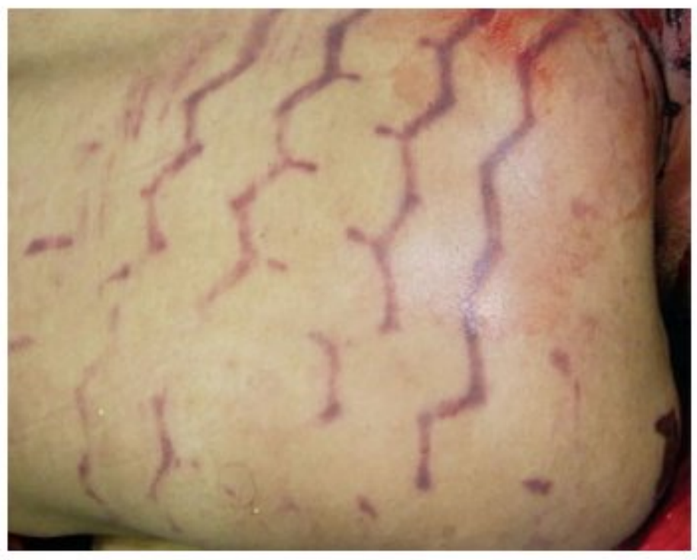
- Also called as Sliding / Gliding / Brush abrasion.
- Produced by sliding movement of broad surface against skin.
- Wider at start, narrower at end with heaping of epithelium → indicates direction.
- When friction is great, grazed area appears like burn, hence called as brush burn.



iii) Imprint abrasion →

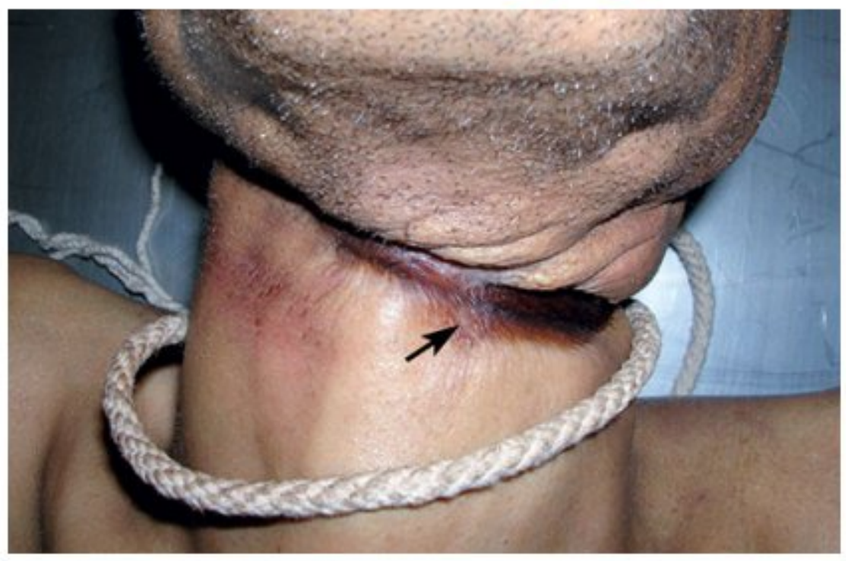
- Also called as Patterned / Impact / Contact abrasion.
- Produced when force is applied perpendicular to skin, reproducing pattern of object.
- Examples → Tyre mark, radiator grill mark, whip mark.





iv) Pressure abrasion →

- Also called as Crushing abrasion.
- Caused by direct impact or pressure with slight movement, crushing superficial skin.
- Dried lesion looks parchment-like, brown to black colour.
- Ex: Ligature mark in hanging / strangulation.



Other types →

i) Contused abrasion / Abraded contusion →

- If contusion is more marked → abraded contusion.
- If abrasion more prominent → contused abrasion.

ii) Postmortem abrasion → Pale, white, dry, parchment-like.

iii) Ant Bite marks → Irregular, map-like, moistly in moist regions (axilla, groin, mouth, eyes).

iv) Fabricated abrasion → Self-inflicted with motive to implicate someone.

v) Nappy abrasion – Seen in infants due to excoriation of skin at groin / buttocks from fecal matter.

Healing →

- Heals by contraction of wound & replacement of lost tissue.
- Intially bright red → covered by scab.
- Microscopic infiltration seen at 4-6 hr; epithelial regeneration at 48 hr.
- Scab falls off by 7-10 days leaving pale hypopigmented area.

Antemortem vs Postmortem abrasion →

Traits	Ante-mortem abrasions	Post-mortem abrasions
1. Site	Anywhere on the body	Usually over the bony prominences
2. Colour	Bright reddish brown	Yellowish, translucent and parchment like
3. Exudation	More ; scab slightly raised	Less ; scab often lies slightly below the level of skin
4. Microscopy	Intravital reaction and congestion seen	No intravital reaction and no congestion

Age of Abrasion →

Age	*Features*
Fresh	Reddish, no scab
12 - 24 hour	Dark red scab
1-2 days	Reddish brown scab
3-5 days	Dark brown scab
5-7 days	Blackish scab shrinks and falling begins from margin
7-10 days	Scab falls off, leaving hypopigmented area

Medicolegal importance →

i. Site of impact and direction of force can be known.

ii. Type of object / weapon used can be identified.

iii. Time of assault can be determined from age of abrasion.

iv. Abrasion over cornea → corneal opacity → grievious hurt.

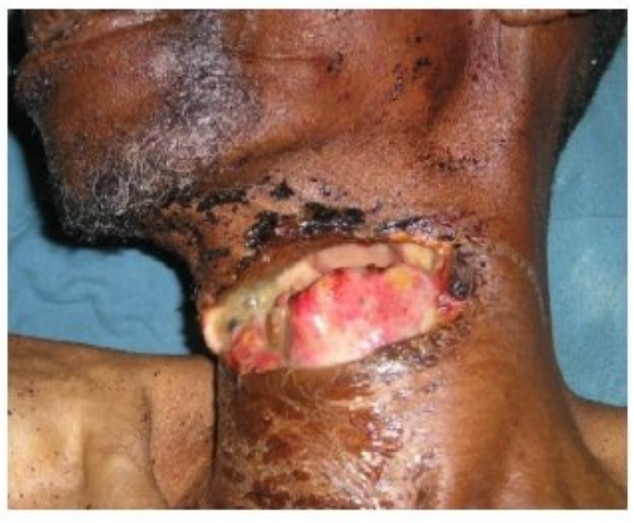
v. Can indicate type of offence → near privat parts considered as sexual offense, neck (throttling), mouth/nose (smothering).

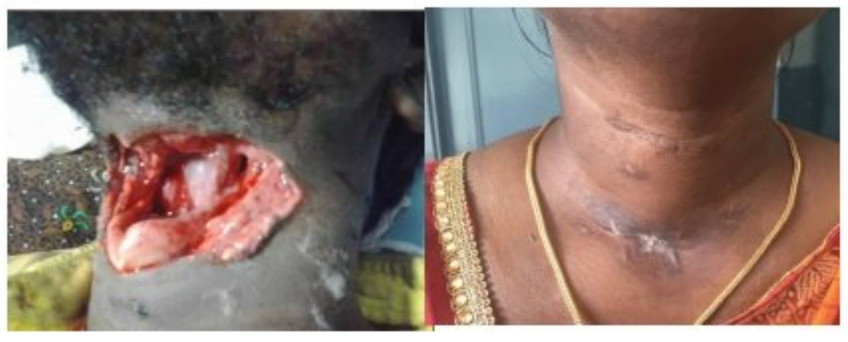
vi. May be only external clue to deep-seated injury.

vii. Foreign material in abrasion (sand, mud, grease) may connect injuries to scene of crime.

4. Difference between Suicidal and homicidal cut throat-

S.No.	*Feature*	*Suicidal cut-throat*	*Homicidal cut-throat*
1.	Situation	Left side of the neck and passing across the front of the throat	Usually on the sides
2.	Level	High, above the thyroid cartilage	Low, on or below the thyroid cartilage
3.	Direction	Obliquely, above downwards and from left to right in right handed persons	Transverse or from below upwards
4.	Number of wounds	Multiple, may be 20–30, superficial, parallel and merge with main wound	Multiple, cross each other at a deep level
5.	Edges	Usually ragged due to overlapping of multiple superficial incisions	Sharp and clean cut, beveling may be seen
6.	Hesitation cuts	Present[30]	Absent
7.	Tailing	Present	Absent
8.	Severity	Less severe, one wound is severe, but sometimes, there may be 2–3	More severe, all tissues including vertebrae may be cut
9.	Wounds in other parts of body	May be present across wrists, groin and thighs	No wounds on wrists, but severe injuries on head may be present
10.	Defense wounds	Absent, unintentional cuts may be found	Present, unless taken unaware
11.	Hands	Weapon may be firmly grasped due to cadaveric spasm	Fragments of clothing or hair of the assailant may be grasped
12.	Weapon at site	Usually present	Usually absent
13.	Vessels	As head is thrown back, carotid artery escapes injury	Jugular vein and carotid artery are likely to be cut
14.	Clothes	Not cut or damaged	May be cut, corresponding to injuries in the body
15.	Blood stains	If standing in front of mirror, then splashing on the mirror; stains running downwards on the clothes, front of body and feet	Found in both palms in an effort to cover the wound; if lying down, stains collect behind the neck and shoulder
16.	Circumstantial evidence	Quiet place, such as bedroom or bathroom; suicidal note	Disturbance at scene, footprints outside





5. Contusion types and MLI- Discussed in 1st question

6. Fabricated wound-

- Fabricated wounds are produced by a person on his own body or by another with his consent.

- Fabricated wounds are called as Fictitious / Forged wounds.

Types →

i) Self-inflicted wounds are those inflicted by a person on his own body. Self inflicted injury without conscious suicidal intent is a form of self-mutilation.

ii) Self-suffered wounds are those inflicted by another person on the alleged victim.

Reasons for fabricating injuries →

i) To simulate a criminal offense for false charge:

- By women, to bring a charge of rape.
- Charge an enemy with assault or attempted murder.
- Convert simple injury into grievous one.
- By prisoners, to bring a charge of beating agnst officers.

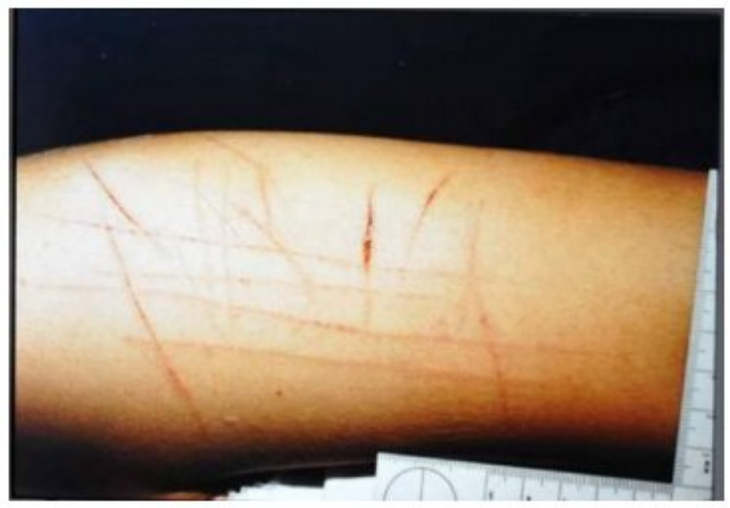
ii) To avert suspicion:

- Destroy evidence of certain injury which might connect a person with crime.
- Assailant may pretend self-defense.
- Policemen / watchmen may feign robbery or alleged attack.

iii) By soldiers and prisoners to escape difficult task.

iv) Suicidal gestures → attempted suicide.

v) For the purpose of insurance frauds.



Features of Fabricated injuries →

- History of assault incompatible with injuries.
- Absence of defense injuries.
- No damage to clothes or inconsistent change.
- Location is easily reachable – usually on the left side.
- Uniform in shape, linear, or slightly curved course of lesions.
- Multiple shallow, non penetrating cuts or fingernail abrasions.

Types of wound seen →

- Mostly incised wounds, sometimes contusions, stab wounds and burns.
- Chop wound of little finger of left hand may be seen too.
- Lacerated wounds are rarely fabricated.
- Burns are superficial and usually seen on left upper arm.

7. Self-Inflicted Wounds-

- A self-inflicted wound is an injury deliberately produced by a person on their own body. It may be inflicted with suicidal intent (to cause death) or as non-suicidal self injury (to relieve tension, gain sympathy or due to mental illness).

Forensic features of self-inflicted wounds →

i) Accessibility →

- Wounds usually on easily reachable areas like mostly on left side
- Rarely seen on inaccessible areas (like back).

ii) Number and Pattern →

- Multiple, superficial wounds often paralell to each other (hesitation cuts).
- Usually one definitive deep wound among several superficial ones.

iii) Hesitation marks →

- Tentative, superficial cuts made before a fatal attempt.
- Common in wrist and neck suicides.

iv) Direction and Orientation →

- Corresponds to handedness of victim (e.g- right handed person cuts left wrist from left to right).

v) Absence of defense wounds.

vi) Weapon and scene →

- Weapon usually present near the body.
- Lack of signs of struggle, forced entry or displacement.

vii) Associated evidence →

- Suicide note, psychiatric history, prior attempts.
- Blood stains consistent with position of body.

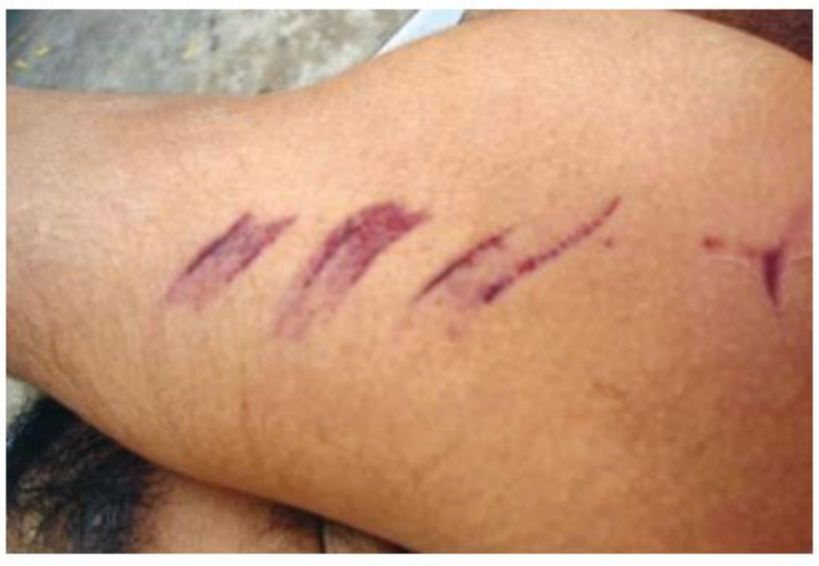
Medicolegal importance →

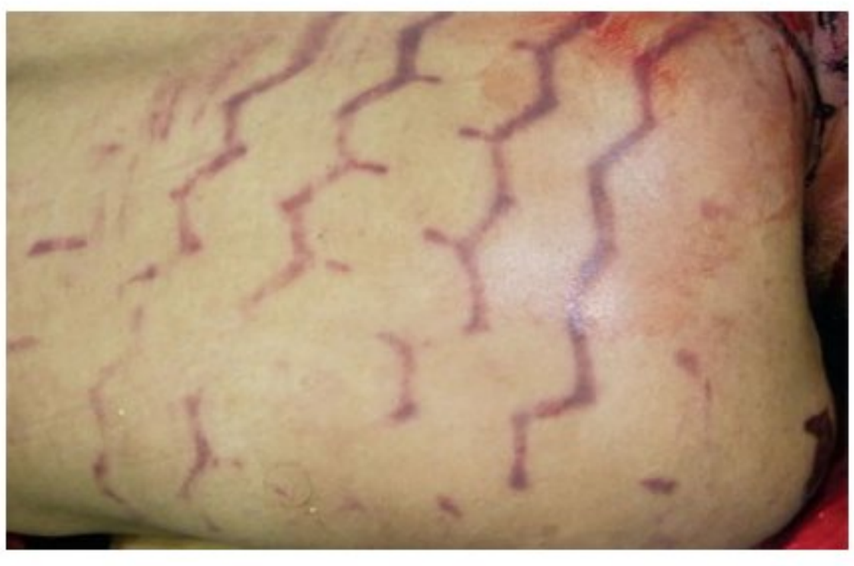
- Helps in determining manner of death (suicidal / homicidal / accidental)
- Guides criminal investigation & court proceedings.

- Affects insurance claims.
- Important in psychiatric evaluation of survivors to prevent repeated attempts.

8. Patterned abrasion-

- Also called as Impact or Contact abrasion.
- It is caused when the force is applied perpendicular to the skin, the cuticle gets crushed at the point of impact and bears the imprint of the object causing it.
- The abrasion is slightly depressed below the surface.
- It tends to be focal, and is commonly seen over bony prominences where a thin layer of skin covers the bone.
- Imprint / Patterned abrasion becomes more defined when injured cuticle dries up and becomes brownish and parchmentized, in contrast with the surrounding uninjured skin surface.
- It is a variation of pressure abrasion.
- Examples: Motor-cycle mark, radiator grill mark over skin in vehicular accident cases or whip marks on beating with whip.





9. Chop wound-

- Deep gaping wounds caused by a blow with the moderately sharp cutting edge of a heavy weapon applied with significant force.

- Considered a combination of sharp and blunt force injury.

Common weapons → Hatchet, Axe, Tomahawk, Saber, Meat cleaver

Characterstic features →

- Incised wound on skin + underlying comminuted fracture or deep bone groove → suggests chop injury.
- Dimensions of wound correspond to cross-section of the blade.
- Margins: Sharp. may show abrasion, bruising, or laceration.
- Severe injury to underlying organs possible.
- Heel of axe (lower end) strikes fast → wound deeper at heel end → indicates position of assailant.
- Undermining: occurs in the direction of the chop.
- In skull: undermined edge of fracture shows direction of force, slanted edge shows side from which force was applied.

Medicolegal importance →

i. Mostly homicidal – usually on exposed parts (head, face, neck, shoulders, extremities)

ii. Accidental – possible with machinery (ex: propeller injuries).

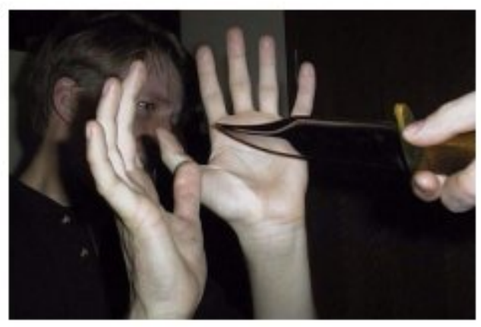
iii. Rarely suicidal.

iv. Wound examination helps to identify:

- Type of weapon, direction of blow, position of assailant.

9. Defense wounds-

– Wounds of the extremities caused by the immediate and instinctive reaction of the victim to ward off an attack.



Types →

a) Active Defense injuries →

- Occur when victim tries to seize or grasp the weapon.
- Typical locations are palms, flexor sides of fingers, Interdigital spaces (especially b/w thumb & index finger).

b) Passive defense injuries →

- Occur when victim raises hands/arms to shield the body.
- Typical locations are: extensor surfaces of forearms, ulnar border of forearms, wrist, knuckles, back of hands, more common on right forearm / hand

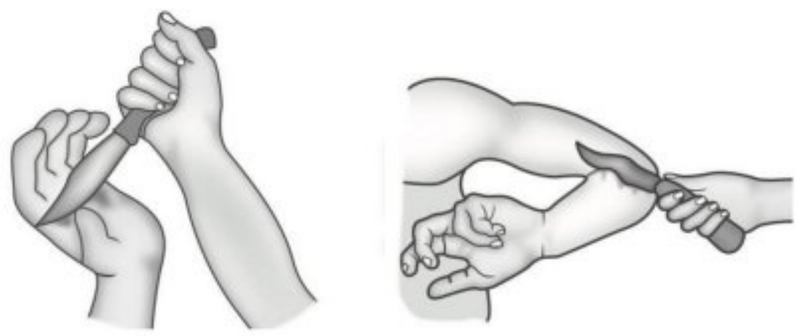


Fig. 11.20: Mechanism of defence wounds

Defense wounds absent in →

a. Victim is unconscious.

b. Taken by surprise

c. Attacked from behind

d. Under influence of alcohol or drugs.

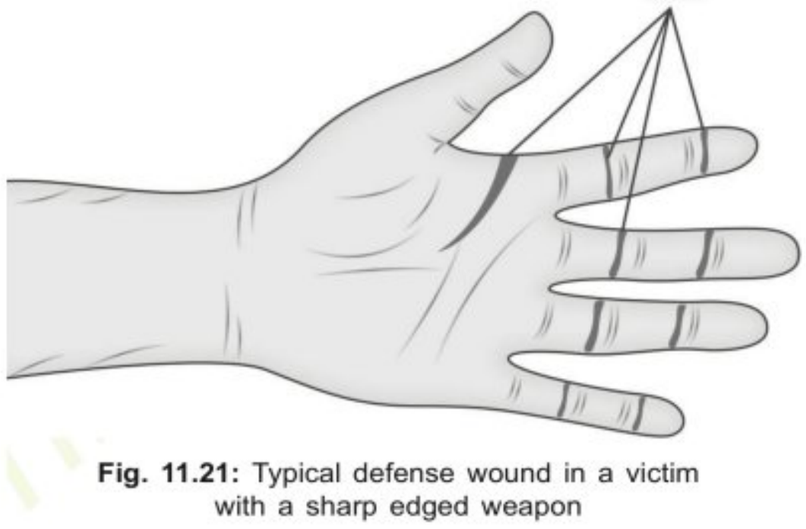


Fig. 11.21: Typical defense wound in a victim with a sharp edged weapon

Weapon type and resulting injuries →

i. Blunt weapon – bruises or abrasions.

ii. Sharp weapon – incised, stab or chop wounds depending on the attack.

iii. Single edged weapon → single cut on palm. or finger bends.

iv. Double edged weapon → cuts on palm and fingers.

v. Cuts are irregular and ragged due to loosened skin tension during gripping.

10. Hesitation cuts-

- Hesitation cuts are superficial, multiple, incised wounds by a person attempting to injure themselves but hesitating due to pain or uncertainity.

- They are most commonly associated with suicide attempts.

Features →

i. Very superficial, involving skin or subcutaneous tissue, rarely reaching deeper structures.

ii. Multiple, often paralell or clustered together.

iii. Variable in length and depth; some extremely shallow, one or more deeper "final" cuts may also be present.

iv. Found on accesible parts of the body - flexor aspect of the wrist, forearm, front of neck, ankles.

v. Usually transverse or oblique direction, strokes show uneven pressure from tentative handling of blade.

vi. Edges: clean, incised margins but without gaping or extensive bleeding due to superficiality.

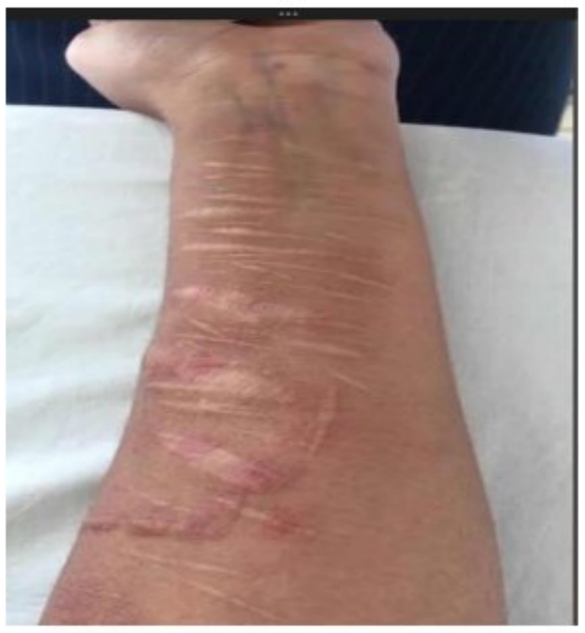
Medicolegal importance →

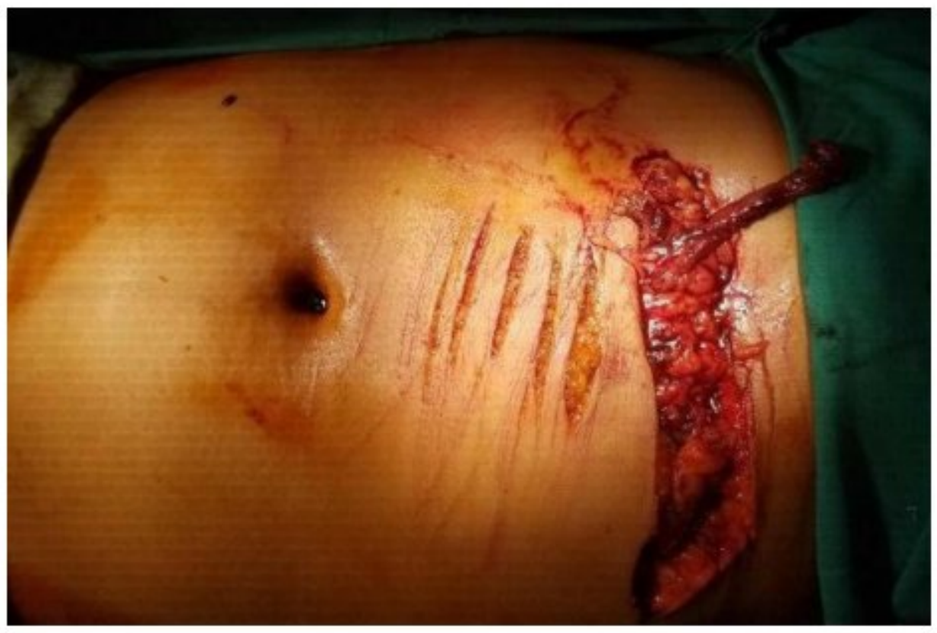
a. Suggestive of self infliction.

b. Differentiate from homicidal wounds.

c. Accidental injuries: generally solitary & follow an accidental mechanism, unlike repetitive tentative strokes.

d. Show indecision, fear or testing of pain threshold before making a committed cut.





11. Harakiri-

- A form of ritual suicide in Japan, traditionally by samurai, involving self-inflicted deep abdominal cuts with a short sword to preserve honor, often followed by decapitation by an accident.
- Wound features – deep, deliberate abdominal incised wounds.
- Associated injuries- may show sharp neck wound from decapitation.
- Forensic importance → Indicates self infliction, absence of defensive wounds.
- Medicolegal aspects → Helps to distinguish suicide from homicide when supported by scene evidence & context.

12. Incised looking lacerated wound-

- Also called as Split Laceration.
- These wounds are caused by blunt force splitting the thickness of the skin most frequently when the skin and soft tissues are crushed b/w impacting force and underlying bone.
- These type of lacerations are usually found in body parts with out much tissue in between.
- Common sites include- scalp, face, shin etc.
- Due to splitting of skin these lacerations are also called as Incised looking lacerations.